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An
Inaugural Essay
on the
Circulation of the Blood.

Submitted to the Medical Faculty
of the University of Pennsylvania, March, 1822

By

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of Philadelphia.

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The Blood is a fluid, of a red colour in man, designed to furnish the materials for the growth, nourishment and repair of the body, and for other particular purposes, which it is not in the scope of this essay to enumerate.

The blood circulates through evry part of the body, in sets of tubes, termed *Arteries* & *Veins*, which are connected with a central organ — the *Heart*.

The *Arteries* are cylindrical tubes, the coats of which are strong and dense, and their internal surface is smooth and polished, to facilitate the passage of the blood along their canals. They are *elastic*, and their caliber is enlarged by distension with blood, or diminished by the opposite state. They have also, independent of their elasticity, the power of *contraction*, by which their caliber is diminished to a still greater degree, than by their Elasticity. They carry the blood *from the Heart*.

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The large Arteries ramify into many branches; these branches again divide, untill the tubes or vessels are so minute, that they cannot be perceived by the eye; and which pervade the flesh so completely that the finest needle does not fail to wound some of them, when inserted in it.

They terminate in veins corresponding with them in minuteneſs, and forming a continuation of their canals, but differing from the Arteries in this, that they (the veins,) propel the blood back toward the Heart, and in other respects, which will be mentioned.

The veins have thinner coats than the arteries, and are less strong. Where they paſs through muscular parts, they are provided with valves, placed at different distances, to prevent any retrograde motion of the blood; whereas the arteries have no valves except where they arise from the Heart.

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The *Heart* is the organ which sets the blood in motion. It is placed in the *Thorax*, or chest. It is a hollow muscle of great power, the internal part of which is divided into four cavities. Two of these cavities are termed *Auricles* and two *Ventricles*; from their position in the chest, they are distinguished as *right* and *left*; we have then the right Auricle and Ventricle, and the left Auricle and Ventricle. There is an opening between each Auricle and its corresponding Ventricle, but no communication between the Auricles, (in the adult,) or the Ventricles. The *parietes* of the Auricles are thinner, and less strong than those of the Ventricles; the *parietes* of the Ventricles are strong and compact, and the fibers are arranged in such a manner as to empty their cavitys ~~of the~~ when they contract.

The office of the Ventricles is, to contract strongly on the blood, to expel it from their cavities and force it through the larger arteries; the Auricles act as reservoirs to the Ventricles—

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-receiving the blood from the veins, and filling the Ventricles again, as soon as they empty themselves. Into the right Auricle opens the two great veins which bring the blood from all parts of the body, (except the Lungs, and Heart) called *Venae Cavae*, and the small *Coronary vein*, which brings it from the substance of the heart.

Into the left Auricle open the four *Pulmonary veins*, which bring the blood from the Lungs.

From the right Ventricle proceeds the Pulmonary Artery, which conveys the blood to the lungs. From the left Ventricle arises the great artery called the *Aorta*, the branches of which carry the blood to all parts of the body.

There are valves placed in the openings between the Auricles and Ventricles:- there are three between the right Auricle and Ventricle, termed *Valvulae Tricuspides*; only two between the left, termed *Valvulae Mitrales*. Three valves are also placed in the mouths of the two great

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Arteries, called *Semilunar valves*. The office common to all the valves is, to shut the openings in which they are placed, and prevent any retrograde motion of the blood — the course of which is determined, and is as follows:—

The right auricle being filled with blood by the *Venae Cavae*, contracts and fills the right ventricle. The right ventricle then contracts: while it contracts the *valvulae Tricuspides* stop the openings between the auricle and the ventricle: the blood cannot flow back into the auricle, but is thrown into the Pulmonary Artery: the Semilunar valves then stop the mouth of the artery, so that the blood cannot regurgitate into the right ventricle. The Pulmonary artery with its branches, conveys the blood to the lungs: in the lungs the blood is subjected to the proceſs of *Respiration*, and is changed from a dark red to a florid red colour — from venous to arterial blood. It is then brought back to the heart and discharged by the four Pulmonary veins into the left Auricle. The left auricle contracts and fills the

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left *ventricle*. The left ventricle then contracts while it contracts, the *valvulae Mitrales* stops the opening between the Auricle and ventricle; the blood is thrown into the *Aorta*, and the *semi lunar valves* prevent its return.

Through the arteries it is propelled, by three causes:—

"1st The impulse given to it by the action of the heart.

"2dly. The Elasticity of the arteries, by which they first give way to the blood impelled into them, and then react upon it; and

"3dly the power of contraction in the arteries, or their irritability.

"In the larger arteries the blood seems to move as it would through an inanimate elastic tube, in consequence of the impulse given by the heart, and kept up by the arteries themselves. In the smaller vessels it seems probable that the motion of the blood depends in a considerable degree upon the contraction which arises from their irritability".
— Wistar's. Anat. Vol 2. pp 221-2.

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The blood paſses from the extreme branches of the arteries into the veins, which carry it back to the heart, and it being returned to the right Auricle by the venae Cavae, the circulation is completed.

"In the proceſs of returning the blood to the heart, two causes are principally engaged, the most efficient of which is the contractile power of the veins themselves." "Cooperating with this cause, is the action of the muscles, as may be illustrated by the familiar example of venaesection." – Note to Richerand pp. 206-7

Although the course of the blood is as has been described, the order in which the cavities of the Heart contract, is not exactly that which has been followed, for the sake of illustration; The Auricles receive blood at the same time, and contract simultaniously; the ventricles are filled at the same time, ~~and~~ contract simultaniously, — and the blood is sent to the lungs & to the general system, at the same time.